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Decomposed bodies – Still an unrewarding autopsy?

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ABSTRACT

One of the classic mistakes in forensic pathology is to regard the autopsy of decomposed body as unrewarding. The present study was undertaken with a view to debunk this myth and to determine the characteristic pattern in decomposed bodies brought for medicolegal autopsy. From a total of 4997 medicolegal deaths reported at an Apex Medical Centre, Yeotmal, a rural district of Maharashtra over seven year study period, only 180 cases were decomposed, representing 3.6% of the total medicolegal autopsies with the rate of 1.5 decomposed body/100,000 population per year. Male (79.4%) predominance was seen in decomposed bodies with male female ratio of 3.9:1. Most of the victims were between the ages of 31 and 60 years with peak at 31–40 years (26.7%) followed by 41–50 years (19.4%). Older age above 60 years was found in 8.6% cases. Married (64.4%) outnumbered unmarried ones in decomposition. Most of the decomposed bodies were complete (83.9%) and identified (75%). But when the body was incomplete/mutilated or skeletonised then 57.7% of the deceased remains unidentified. The cause and manner of death was ascertained in 85.6% and 81.1% cases respectively. Drowning (35.6%) was the commonest cause of death in decomposed bodies with suicide (52.8%) as the commonest manner of death. Decomposed bodies were commonly recovered from open places (43.9%), followed by water sources (43.3%) and enclosed place (12.2%). Most of the decomposed bodies were retrieved from well (49 cases) followed by barren land (27 cases) and forest (17 cases). 83.8% of the decomposed bodies were recovered before 72 h and only in 16.2% cases the time since death was more than 72 h, mostly recovered from barren land, forest and river. Most of the decomposed bodies were found in summer season (42.8%) with peak in the month of May. Despite technical difficulties in handling the body and artefactual alteration of the tissue, the decomposed body may still reveal cause and manner of death in significant number of cases.

1. Introduction

One of the classic mistakes in forensic pathology is to regard the autopsy of decomposed body as unrewarding.[1] After death of a person, a body is subject to the inevitable consequences of autolysis and putrefaction, both of which may result in marked changes in the tissues with loss of cellular detail on subsequent microscopy.[2] The changes in advanced decomposition may result in complete loss of tissues, culminating in skeletonisation.[3] Whatever the time scale, the general order of putrefaction is similar, though the degree of advancement may vary between different areas of even the same corpse.[4] Moreover, there is no definitive scientifically based approach to use stage of putrefaction for estimating the time since death.[5] Decomposition changes are known for their misinterpretation. The early changes of decomposition too are important because they may be confused with the signs of violence or trauma.[6] In advanced decomposition, most of the injuries are lost or altered and it becomes very difficult to deduce any inference from the lesion of natural disease.[7] For this reason it is sometimes perceived that the autopsy examination is of limited value in decomposed bodies. Present study was undertaken with a view to debunk the myth that the autopsy of the decomposed body is unrewarding and to determine the characteristic pattern in such cases.

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Table 1
Incidence of decomposed bodies out of the medicolegal deaths during period 2001–2007.

Year	Total autopsies	Decomposed bodies			
		M	F	T	%
2001	517	12	3	15	2.9
2002	480	9	5	14	2.9
2003	545	13	3	16	2.9
2004	760	25	5	30	3.9
2005	788	24	5	29	3.7
2006	967	33	11	44	4.6
2007	940	27	5	32	3.4
Total	4997	143	37	180	3.6

2. Material and methods

The study attempted to review all medicolegal deaths during the period January 2001 to December 2007. All the autopsies had been performed in the mortuary, Forensic Medicine Department of Government Medical College at Yeotmal, a rural district of Maharashtra, India. The district has a population of 2,458,271 spread in an area of 13,582 km^2. The centre is an Apex Medical Centre, where about 70% of the total medicolegal autopsies done across the district are performed here. The police department in India is legally bound to arrange autopsies in all medicolegal deaths. The medicolegal deaths are deaths occurring in unnatural (including suicidal, homicidal and accidental), suspicious or where cause of death is unknown. The accompanying police papers provide much of the information regarding age, sex, residence, marital status, date of death, reasons and manner of death, and all other relevant information about the case. Cases were recorded as decomposed if there was significant discolouration, smell, marbling, purging of putrefactive fluids, insect activity, peeling of skin, passing of rigor mortis, and/or bloating either in combination of two or more. There are various factors, which affect the rate of decomposition. So in the present study, after considering the factors affecting rate of decomposition, the time since death was determined from the autopsy findings, and history from police/relatives about missing of the deceased or last seen. Out of a total of 4997 medicolegal deaths, only 180 cases were decomposed and were included in the present study. The autopsy is followed by mandatory police inquiry and Magistrate's verdict report, especially in regard to manner of death. Hence, the police records were again reviewed for confirmation of information.

3. Results

3.1. Incidence of decomposed bodies

The incidence of decomposed bodies out of the total medicolegal deaths is shown in Table 1. Of the total 4997 medicolegal deaths during seven-year period from 2001 to 2007, only 180 cases were decomposed, representing 3.6% of the total medicolegal autopsies. The average number of decomposed bodies per year was 25.7 with range 14–44. The rate of decomposed bodies in the region is 1.49 per 100,000 population per year.

Table 2
Age and gender distribution in decomposed bodies.

Age groups	M	%	F	%	T	%
Fetal	1	0.7	2	5.4	3	1.7
Newborn	2	1.4	3	8.1	5	2.8
01–10 yrs	2	1.4	0	0.0	2	1.1
11–20 yrs	9	6.3	5	13.5	14	7.8
21–30 yrs	30	21.0	3	8.1	33	18.3
31–40 yrs	40	28.0	8	21.6	48	26.7
41–50 yrs	29	20.3	6	16.2	35	19.4
51–60 yrs	19	13.3	6	16.2	25	13.9
61–70 yrs	9	6.3	3	8.1	12	6.7
71& >	2	1.4	1	2.7	3	1.7
Total	143	79.4	37	20.6	180	100.0

Table 3
Distribution of marital status of decomposed bodies.

Marital Status	M	%	F	%	T	%
Married	90	62.9	26	70.3	116	64.4
Unmarried	32	22.4	8	21.6	40	22.2
Not known	21	14.7	3	8.1	24	13.3
Total	143	79.4	37	20.6	180	100.0

3.2. Age and gender

The age and sex distribution is given in Table 2. In decomposed bodies, 79.4% of the victims were male and 20.6% were female with male female ratio of 3.9:1. The age ranges from fetal age to 78 years in male and fetal age to 75 years in female. 78.3% of the decomposed bodies were between the ages of 21–60 years with peak incidence at 31–40 years (26.7%) followed by 41–50 years (19.4%) and 21–30 years (18.3%). Only two cases (1.1%) of the decomposed bodies were below the age of 10 years and 8.4% were above the age of 60 years. But 7.8% of the victims were between the ages of 11–20 years.

3.3. Marital status

The distribution of marital status of the decomposed bodies is given in Table 3. In decomposed bodies, 64.4% of the victims were married and 22.2% unmarried with married unmarried ratio equal to 2.9:1. The marital status was not known in 13.3% cases, mostly males.

3.4. Condition of decomposed bodies and animal activity

Condition of the decomposed body, whether complete, incomplete, skeletonised, or with adipocere formation, and with involvement of animal activity is shown in Table 4. In 85.6% cases, the decomposed bodies brought for medicolegal autopsy was complete. The decomposed bodies were incomplete or mutilated in 10% cases and skeletonised in 4.4% cases. Total six cases (3.3%) had shown adipocere formation along with decomposition. The body was attacked in 13.9% cases by land/aquatic animals.

3.5. Identification of deceased

As per Table 5, the decomposed body was identified in 135 cases (75%) and remains unidentified in 45 cases (25%). When complete body was available, the deceased was identified in 80.5% cases and

Table 4
Distribution of condition of decomposed bodies with animal activity.

Condition of body	Decomposed body					
	M	%	F	%	T	%
Complete body	122	85.3	32	86.5	154	85.6
Incomplete body	13	9.1	5	13.5	18	10.0
Partial skeletonised	6	4.2	0	0.0	6	3.3
Near skeletonised	2	1.4	0	0.0	2	1.1
With adipocere	5	3.5	1	2.7	6	3.3
With animal activity	20	14.0	5	13.5	25	13.9

Table 5
Identification of deceased in decomposed bodies.

Identification of deceased	Complete body				Incomplete/ skeletonised			
	M	F	T	%	M	F	T	%
Identified	98	26	124	80.5	10	1	11	42.3
Unidentified	24	6	30	19.5	11	4	15	57.7
Total	122	32	154	100.0	21	5	26	100.0

remains unidentified in only 19.5% cases. But when the body was incomplete/mutilated or skeletonised, then 57.7% of the cases remained unidentified.

3.6. Cause of death

As per Table 6, drowning (35.6%) was the commonest cause of death in decomposed bodies followed by poisoning (13.9%), and hanging (12.8%). The natural death was noted in 12.2% cases and mechanical injury in 6.7% cases. The other causes of death were seen in 2.2% cases, including electric shock (three cases) and burns (one case). Non-viable fetus was also seen in 2.2% of the decomposed bodies. Thus, the cause of death was determined in 85.6% cases of decomposed bodies. In 14.4% of the decomposed bodies, the final cause of death could not be ascertained (i.e. negative autopsy) even after ancillary investigation like chemical analysis and histopathological examination. Viscera were preserved for chemical analysis in 80% (145 cases) and histopathological examination was done in 10% (18 cases). On chemical analysis, poisoning was detected in 25 cases (17.2%), *all insecticidal poison*; and alcohol in six cases (4.1%), *the concentration was more than* 110 *mg% in all cases*. In histopathological examination, the findings suggestive of natural death were seen in only 4 cases (22.2%).

3.7. Manner of death

As shown in Table 7, the manner of death was suicidal in 52.8% and natural in 15.6% decomposed bodies brought for medicolegal autopsy. Accidental manner were seen in 7.8% decomposed bodies and homicidal in 5%. Thus, the manner of death was known in 81.1% cases. In 18.9% decomposed bodies, the manner of death was not ascertained even after Magistrate's verdict report.

3.8. Site of recovery

As per Table 8, most number of decomposed bodies was recovered from open places (outdoor) in 43.9%, followed by water source in 43.3% and enclosed place (indoor) in 12.2% cases. In only one case the decomposed/buried body was exhumed from the grave. However, most of the decomposed bodies were retrieved from well (49 cases), followed by barren land (27 cases) and forest (17 cases).

In enclosed place, 8.3% of decomposed bodies were recovered from the home. Four cases (2.2%) cases were found decomposed in the morgue due to improper preservation and storage of dead body in cold storage due to electricity failure and procedural delay in police inquest. In open place, most number of decomposed bodies was recovered from barren land (15%) followed by forest (9.4%) and farm/agricultural field (8.3%). The decomposed bodies were found road side in 7.8% cases. In water source, most number of decomposed bodies was retrieved from well in 27.2% followed by river in 7.8%. The decomposed bodies recovered from lake and canal in 3.3% cases each.

3.9. Time since death

The distribution of time since death of the decomposed bodies is given in Table 9. Time since death for most of the decomposed bodies was between 24 and 48 h (44.4%) followed by 12–24 h in 22.2% cases and 48–72 h in 17.2% cases. In 10.6% cases, the time since death was 3–5 days. In only ten cases (5.6%), the time since death was more than 5 days. Thus, most of the decomposed bodies were retrieved before 72 h (83.8%).

Between 12 and 24 h, decomposed body was recovered mostly from open place in 45% (mainly from agricultural field) followed by water source in 37.5% (mostly from well). Between 24 and 48 h,

Table 6
Distribution of cause of death in decomposed bodies.

Cause of death	M	%	F	%	T	%
Drowning	47	32.9	17	45.9	64	35.6
Poisoning	22	15.4	3	8.1	25	13.9
Hanging	22	15.4	1	2.7	23	12.8
Natural Death	16	11.2	6	16.2	22	12.2
Mechanical Injury[a]	9	6.3	3	8.1	12	6.7
Other	3	2.1	1	2.7	4	2.2
Non-Viable Fetus	2	1.4	2	5.4	4	2.2
Negative autopsy	22	15.4	4	10.8	26	14.4
Total	143	79.4	37	20.6	180	100.0

[a] Two cases of head injury are associated with drowning.

Table 7
Distribution of manner of death in decomposed bodies.

Manner of death	M	%	F	%	T	%
Homicidal	5	3.5	4	10.8	9	5.0
Accidental	14	9.8	0	0.0	14	7.8
Suicidal	76	53.1	19	51.4	95	52.8
Natural	21	14.7	7	18.9	28	15.6
Undetermined	27	18.9	7	18.9	34	18.9
Total	143	79.4	37	20.6	180	100.0

Table 8
Distribution of decomposed bodies as per the site of recovery.

Site of Recovery	M	%	F	%	T	%
Home	12	8.4	3	8.1	15	8.3
Hotel	1	0.7	0	0.0	1	0.6
Prison	1	0.7	0	0.0	1	0.6
Morge	3	2.1	1	2.7	4	2.2
Temple	1	0.7	0	0.0	1	0.6
Indoor/enclosed place	**18**	**12.6**	**4**	**10.8**	**22**	**12.2**
Road Side	7	4.9	7	18.9	14	7.8
Farm/Agricultural field	14	9.8	1	2.7	15	8.3
Barren Land	23	16.1	4	10.8	27	15.0
Forest	16	11.2	1	2.7	17	9.4
Nursery	2	1.4	0	0.0	2	1.1
Beside Market	1	0.7	0	0.0	1	0.6
Bus Stand	2	1.4	0	0.0	2	1.1
Behind College	1	0.7	0	0.0	1	0.6
Outdoor/open place	**66**	**46.2**	**13**	**35.1**	**79**	**43.9**
Well	32	22.4	17	45.9	49	27.2
Pond	2	1.4	0	0.0	2	1.1
Lake	6	4.2	0	0.0	6	3.3
River	13	9.1	1	2.7	14	7.8
Canal	4	2.8	2	5.4	6	3.3
Tank	1	0.7	0	0.0	1	0.6
In Water	**58**	**40.6**	**20**	**54.1**	**78**	**43.3**
Buried	**1**	**0.7**	**0**	**0.0**	**1**	**0.6**
Grand total	**143**	**79.4**	**37**	**20.6**	**180**	**100.0**

Table 9
Time since death in relation to site of recovery.

Site of recovery	Time since death																							
	12–24 h				24–48 h				48–72 h				3–5 days				5–10 days				> 10 days			
	M	F	T	%	M	F	T	%	M	F	T	%	M	F	T	%	M	F	T	%	M	F	T	%
Home	3	1	4	10.0	8	2	10	12.5	1	0	1	3.2	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Hotel	0	0	0	0.0	1	0	1	1.3	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Prison	0	0	0	0.0	1	0	1	1.3	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Morge	1	1	2	5.0	1	0	1	1.3	1	0	1	3.2	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Temple	1	0	1	2.5	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Indoor/enclosed place	**5**	**2**	**7**	**17.5**	**11**	**2**	**13**	**16.3**	**2**	**0**	**2**	**6.5**	**0**	**0**	**0**	**0.0**	**0**	**0**	**0**	**0.0**	**0**	**0**	**0**	**0.0**
Road Side	4	2	6	15.0	3	4	7	8.8	0	1	1	3.2	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Farm/Agricultural field	6	1	7	17.5	6	0	6	7.5	2	0	2	6.5	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Barren Land	2	0	2	5.0	10	2	12	15.0	7	0	7	22.6	1	2	3	15.8	2	0	2	28.6	1	0	1	33.3
Forest	1	0	1	2.5	1	0	1	1.3	4	0	4	12.9	6	0	6	31.6	3	1	4	57.1	1	0	1	33.3
Nursery	0	0	0	0.0	0	0	0	0.0	2	0	2	6.5	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Beside Market	1	0	1	2.5	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Bus Stand	1	0	1	2.5	1	0	1	1.3	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Behind College	0	0	0	0.0	1	0	1	1.3	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Outdoor/open place	**15**	**3**	**18**	**45.0**	**22**	**6**	**28**	**35.0**	**15**	**1**	**16**	**51.6**	**7**	**2**	**9**	**47.4**	**5**	**1**	**6**	**85.7**	**2**	**0**	**2**	**66.7**
Well	7	4	11	27.5	17	7	24	30.0	4	5	9	29.0	4	1	5	26.3	0	0	0	0.0	0	0	0	0.0
Pond	0	0	0	0.0	1	0	1	1.3	0	0	0	0.0	1	0	1	5.3	0	0	0	0.0	0	0	0	0.0
Lake	3	0	3	7.5	1	0	1	1.3	0	0	0	0.0	1	0	1	5.3	1	0	1	14.3	0	0	0	0.0
River	1	0	1	2.5	7	0	7	8.8	3	0	3	9.7	2	1	3	15.8	0	0	0	0.0	0	0	0	0.0
Canal	0	0	0	0.0	4	2	6	7.5	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Tank	0	0	0	0.0	0	0	0	0.0	1	0	1	3.2	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
In water	**11**	**4**	**15**	**37.5**	**30**	**9**	**39**	**48.8**	**8**	**5**	**13**	**41.9**	**8**	**2**	**10**	**52.6**	**1**	**0**	**1**	**14.3**	**0**	**0**	**0**	**0.0**
Buried	**0**	**0**	**0**	**0.0**	**0**	**0**	**0**	**0.0**	**0**	**0**	**0**	**0.0**	**0**	**0**	**0**	**0.0**	**0**	**0**	**0**	**0.0**	**1**	**0**	**1**	**33.3**
Grand total	**31**	**9**	**40**	**22.2**	**63**	**17**	**80**	**44.4**	**25**	**6**	**31**	**17.2**	**15**	**4**	**19**	**10.6**	**6**	**1**	**7**	**3.9**	**3**	**0**	**3**	**1.7**

most of the bodies were recovered from water sources in 48.8% (mainly from the well), followed by open place in 35% (mainly from barren land). Similarly between 48 and 72 h, decomposed body was mostly found in open place in 51.6% (mainly barren land) followed by water source in 41.9% (mainly well).

In enclosed place, most of the bodies were found in the home, almost all recovered within 48 h. None of the decomposed body was recovered from enclosed place after 72 h. 21.5% (17 out of 79) cases were recovered from open place after 72 h, all from barren land and forest. 14.1% (11 out of 78) cases were retrieved from water source after 72 h, mostly from well and river.

3.10. Seasonal variation

As shown in Table 10, the highest incidence of decomposed body was observed in summer months of March to June comprising of 42.8% of all decomposed bodies followed by 38.9% cases occurring in rainy or monsoon season of July to October. The least suicides were seen in the winter months of November to February in 18.3% cases. The peak incidence of decomposed body was seen in the month of May (26 cases) followed by October and September (22 and 21 cases respectively).

4. Discussion

Autopsies on decomposed bodies present a number of problems. Bodies are often difficult to handle due to slippage and subcutaneous fluid accumulations, and insect activity may also be considerable, making dissection difficult and altering physical findings.[8] It is always a challenging task for a forensic expert when he receives a badly decomposed body. In such cases, often the opinion regarding identity, cause, manner and time since death has been requisitioned by the investigating agencies. One of the classical mistakes in forensic pathology is to regard the autopsy of decomposed body as unrewarding.[1] Also there are more chances of misinterpretation in the decomposed bodies[9] due to artefactual alteration of tissue structure and microscopic features.

Out of the total 4997 medicolegal deaths during the study period of seven years, an incidence of 3.6% decomposed body was recorded. The rate of decomposed bodies in the region was 1.49/100,000 population per year. Thus the decomposed bodies make up only a small percentage of medicolegal autopsies in the district. Byard et al.,[8] Mirza and Makhdoom,[10] Batra et al.,[11] and Job[12] also reported a low incidence of 6.3%, 10%, 5.9% and 7.8% decomposed bodies respectively.

Table 10
Month wise distribution of decomposed bodies.

Month and Season	M	%	F	%	T	%
March	15	10.5	3	8.1	18	10.0
April	13	9.1	1	2.7	14	7.8
May	22	15.4	4	10.8	26	14.4
June	12	8.4	7	18.9	19	10.6
Summer Season	**62**	**43.4**	**15**	**40.5**	**77**	**42.8**
July	13	9.1	0	0.0	13	7.2
August	11	7.7	3	8.1	14	7.8
September	17	11.9	4	10.8	21	11.7
October	16	11.2	6	16.2	22	12.2
Rainy Season	**57**	**39.9**	**13**	**35.1**	**70**	**38.9**
November	8	5.6	4	10.8	12	6.7
December	4	2.8	0	0.0	4	2.2
January	5	3.5	2	5.4	7	3.9
February	7	4.9	3	8.1	10	5.6
Winter Season	**24**	**16.8**	**9**	**24.3**	**33**	**18.3**
Grand total	**143**	**79.4**	**37**	**20.6**	**180**	**100.0**

In the present series, male predominance was seen with peak age of 31–40 years followed by 41–50 years. Similar predominance has been noted in other studies of decomposition.[8,12,13] In general, male predominance is seen with peak age of 21–30 years in all medicolegal deaths.[11] The incidence of decomposition was more in elderly age group of above 60 years than compared to younger age below 10 years. This is probably because of their social isolation, poor health and financial condition and deficient family support. However, it is well documented that elderly people living alone are at risk for being found helpless or dead at home.[14]

As similar to other studies in general, predominance of married victims was seen in decomposed bodies.[15,16] The marital status was not known in 13.3% cases, mostly males. In India, the cultural and social practices related to marriage are more pertinent to the females, particularly mangalsutra (black beaded chain worn around neck after marriage), toe rings, vermillion over forehead, etc., which can be evident even in the decomposed bodies of the married female. However, in adult males there is nothing from which the marital status of the deceased can be known.

Most of the decomposed bodies brought for medicolegal autopsy were complete. The bodies were incomplete or skeletonised in only 14.5% cases with animal activity seen in 13.9% cases. This is probably because of the presence of dead bodies in closed places and in well water, and in clothed condition. In the present study, 43.9% of the decomposed bodies were found in an open place. In India, animals such as rats, dogs, cats, jackals, and birds like vultures, may attack a dead body and mutilate it in a very short time, especially when the body is exposed in an open field on the outskirts of a village or town.[17] Jani and Gupta[18] reported postmortem scavenging in 1.48% cases. Mirza and Makhdoom[10] noted animal and insect activity in 5.77% cases of medicolegal autopsies.

Identification is one of the main concerns of investigating agencies in decomposed or skeletonised bodies. Putrefaction itself may significantly alter physical features thus precluding visual identification. However, features such as tattoos and scar may still be present, which can assist with identification.[8] Fingerprints and dental comparisons represent the most scientifically reliable methods of identification.[19] However, dental comparison is not practicable in India and hence not done. Facial reconstruction and superimposition also helps in identification of the deceased in skeletonised body.[4,20] In India, police usually established the identity of a dead body, with the help of a relatives and acquaintances. The clothes of the deceased and belongings help in the identity of the decomposed bodies along with *tattoos, scar and other peculiar features*. In the present study, the decomposed bodies were identified in 75% cases and remains unidentified in 25% cases. It is usual that most of the decomposed cases is identified when complete body was recovered/available, which is clearly evident in the present study too. When the complete body was available, then victims remains unidentified in only 19.5% cases as compared to 57.7% when the body was incomplete/mutilated or skeletonised. Nowadays, DNA profiling may be useful for identification in such circumstances from the bones and teeth,[20] but it is not routine.

Although loss of tissue structure due to decomposition may make postmortem assessment difficult, the present study has shown that a cause of death could be determined in 85.6% and the manner of death in 81.1% cases of decomposed bodies. Byard et al.[8] reported determination of cause of death in 89% and manner of death in 93% cases. In the present series, drowning was the commonest cause of death followed by poisoning and hanging; and suicidal was the commonest manner of death followed by natural death. Job[12] also reported the cause of death in 71.6% cases with drowning as the commonest cause of death. This differs from other study of decomposition, which reported cardiovascular disease as the commonest cause of death followed by carbon monoxide poisoning; and natural death as the commonest manner of death followed by suicide.[8] *In India, autopsy is compulsory by law in medicolegal deaths*. In "spot dead" cases, the police also provide an additional 'spot inquest' at the time of autopsy that contains the detailed description of the scene of crime/death in relation to the dead body with pictorial representation and the photographs of the spot. This information may help in framing the cause of death in such circumstances of decomposition. The autopsy is followed by mandatory police inquiry and Magistrate's verdict report, especially in regard to manner of death. In cases where the cause of death was reserved after autopsy, the doctor finalise the opinion after considering the toxicological and/or histological findings along with the police investigation report.

The cause of death could not be ascertained (i.e. negative autopsy) in 14.4% decomposed bodies and manner of death was undetermined even after Magistrate's verdict report in 18.9% cases. Job[12] stated that the cause of death was not known in 28.4% decomposed bodies. However, Batra et al.[11] reported negative autopsy of 4.8% in total medicolegal deaths. Toxicological evaluations were sometimes difficult to interpret with advanced putrefaction and meaningful histological studies were not possible. Although immunohistochemistry has been utilized in these circumstances,[21] it is not routine and was not used in any of the cases in this series. In the present study, chemical analysis was done in almost 80% cases in comparison to 10% histopathological examination. Histological findings suggestive of natural death were present in only four cases. Such less number of histological samples preserved in the present series was not only due to decomposition but also it was not required in most of the cases. In decomposed bodies, histological studies were not found helpful due to the decomposition of the tissue. Moreover, Molina et al.[22] reported that in all medicolegal autopsies, where the cause and manner of death are determined during gross autopsy examination, histological examination will change the cause of death in less than 1% of the cases, particularly the natural deaths and does not affect the determination of the manner of death. Thus microscopic examination should be used as needed, in circumstances but is not necessary as a matter of routine. As a result of decomposition, alcohol and cyanide may be found in the body, which may be misinterpreted as due to 'poisoning'. But the alcohol concentration does not go above 20 mg% and cyanides are found in traces only.[23,24] Decomposition also causes an increase in the concentration of carbon monoxide in blood up to 19%. Many substituted phenols are found in decomposition tissues, especially p-hydroxyphenol derivatives. In buried bodies, arsenic may be imbibed from the surrounding earth.[24] However, in the present study, poisoning was found in 25 cases, all insecticidal poison; and alcohol in six cases, the concentration was more than 110 mg% in all cases on toxicological analysis.

In the present series, most of the decomposed bodies were recovered from open places (43.9%) usually barren land, forest, and the farm. Almost equal numbers of decomposed bodies were retrieved from the water sources mainly the well. This is probably because of two reasons, firstly, the victims may prefer such places so as not to be noticed or rescued. Secondly, due to delay in the recovery of the body from such isolated places. Body in the water may also not be found immediately despite intensive searches and will be noticed only when it floats on the surface of the water. Honigschnabl et al.[13] claimed decomposition as a marker of social isolation, particularly in the elderly probably due to psychiatric illness. Job[12] reported 42.6% of the decomposed bodies recovered from water sources.

Much of the difficulty in determining the time since death results from lack of systematic observation and research on the decomposition rate of the human body.[25] Decomposition results from the dual effects of tissue autolysis and putrefaction and is most likely to

occur when there has been a prolonged interval between death and a body being found or presented to autopsy, or when a body is exposed to high environmental temperatures.[8] In the present study, time since death for most of the decomposed bodies was between 24 and 48 h followed by 12–24 h and 48–72 h. After 72 h, none of the decomposed bodies was recovered from enclosed place in comparison of 21.5% from open place and 14.1% from water source. Decomposition may differ from body to body, from environment to environment, and even from one part of the same corpse to another. Immersion in water or burial will slow the process of decomposition. It is said that a body in air will decomposed twice as fast as a body in water and four times as fast as a body under the ground.[6] However, in India, the ambient temperature of the region is usually high and drowned bodies are usually more decomposed. This is perhaps because the body when taken out of the water will decompose rapidly, due to the facts that, such dead body is saturated with water and gets optimum temperature in air for the growth of micro-organism.[26] Also, the aquatic animal may cause postmortem injury, which will favour the process of decomposition by allowing invasion of the body by micro-organism.[26]

As similar to other authors, most of the decomposed bodies were observed in summer season with peak in the month of May.[8,17,26] Elevated temperatures will obviously hasten decomposition and this may be due to external or internal heat. This may be augmented when there is associated rainfall.[27] Thus, decomposition occurs more often and rapidly over hot summer months, as was shown in our study with 2.3 times the number of cases occurring in summer than in winter.

While it is likely that more information may be gleaned from fresh complete bodies, decomposed bodies may reveal both the cause and manner of death in majority of the cases. Identification is difficult in advanced decomposition, particularly when the body is incomplete or skeletonised. But DNA profiling may be helpful in such circumstances. Putrefaction is not, therefore, a reason to argue against the performance of a full autopsy. The autopsy on decomposed body should never be considered as unrewarding, because many possibilities can be excluded by a careful autopsy performed on a badly decomposed body.

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